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TP 1624

Marine Casualty Investigations

Enquêtes sur les accidents maritimes

Investigation Report to the Minister pursuant to sections 542 or 545 of the Canada Shipping Act

Rapport d'investigation au Ministre conformément aux articles 542 ou 545 de la Loi sur la marine marchande du Canada

Canada

Ce rapport est aussi disponible en français.

REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES ATTENDING THE EXPLOSION ON BOARD THE CANADIAN FISHING VESSEL "BENRIC" AT SHELBURNE HARBOUR, NOVA SCOTIA, MARCH 24, 1987, WITH THE SUBSEQUENT DEATH OF ONE CREW MEMBER AND INJURIES TO FOUR OTHER PERSONS.

REPORT No. 477

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REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES ATTENDING THE EXPLOSION ON BOARD THE CANADIAN FISHING VESSEL "BENRIC" AT SHELBURNE HARBOUR, NOVA SCOTIA, MARCH 24, 1987, WITH THE SUBSEQUENT DEATH OF ONE CREW MEMBER AND INJURIES TO FOUR OTHER PERSONS.

Particulars of Vessel

Name	"BENRIC"
Official Number	329023
Port of Registry	Weymouth, N.S.
Gross Tonnage	70
Net Tonnage	34
Length	18.84 m
Breadth	6.10 m
Draught (At time of incident)	1.3 m forward 4 m aft
Type	Wooden fish dragger
Built	1968, Meteghan, N.S.
Propulsion	400 BHP, Cummins diesel, one propeller
Cargo	Nil
Crew	3
Visitors	2
Owner	R.J. King Fisheries Ltd. Meteghan, N.S.
Operator	G.A. King Meteghan, N.S.

Propane Appliances

Stove	Wedgewood Industries, No. W382312 Model No. T2150BG, with 4 top burners of maximum 5,200 BTU per hour each and 1 oven burner of 7,100 BTU per hour, equipped with pilot

	light.
Hot Water Heater	GSW Inc., Ontario, 'Fergus' Model No. 5-G30 PC-06, serial No. 8509652, of maximum BTU 28,500 per hour, equipped with thermostat and pilot light.
Refrigerator	Buroclean, Cambridge, Model No. RM461, BTU 1,000 per hour.

Description of Vessel

The "BENRIC" was a wooden, inshore fishing vessel whose hull was transversely divided by 2 wooden watertight bulkheads into three compartments; namely, accommodation in the forward section, a fish hold amidships and an engine-room aft.

A wheel-house was situated immediately above the accommodation; the wheel-house was, in effect, a deck-house attached to the deck and did not form part of the structural strength of the hull.

The accommodation was itself divided by a transverse partition bulkhead into a sleeping area forward and a galley/eating area aft; access to the accommodation was from the wheel-house via an opening in the deck and a near vertical ladder which led into the sleeping area and was attached to the partition bulkhead. (See sketch.)

A hot water heater, situated in the wheel-house, and a refrigerator and galley stove situated in the accommodation were all operated by propane.

The "BENRIC" was in possession of a valid Steamship Inspection Certificate (SIC 29) issued at Louisbourg, Nova Scotia, January 1, 1985 and due to expire October 24, 1988, short termed to allow for dry-docking prior to inspection.

NOTE: All times in this report are expressed in Atlantic Standard Time (UTC minus 4 hours).

Background

The Canadian fishing vessel "BENRIC" had discharged her catch at Shelburne during Saturday, March 21, 1987; prepara-

tions for making another trip had been carried out during Monday and Tuesday, March 23 and 24.

At 2310, March 24, during final preparations for departure, an explosion occurred in the accommodation which resulted in the death of one crew member and injuries to four other persons.

The accommodation and wheel-house were completely destroyed and she sank at her berth, in position 43°45.2'N, 65°19.3'W, becoming a total loss. Her estimated value was $450,000.

Pollution as a result of this incident was minimal consisting of slight seepage of diesel fuel oil from the submerged fuel tanks.

Particulars of Deceased

Name	David Glendon Trim
Position aboard vessel	Deck-hand
Age	22
Address	Saulnierville Station Nova Scotia

Narrative

The "BENRIC" had completed a successful trip and had discharged her catch at Shelburne on Saturday, March 21, 1987 when her four crew members secured the vessel at the Government Public Wharf, Shelburne and proceeded to their homes at Meteghan and Saulnierville, some 150 km away by road.

It was the intention to resume fishing on Monday, March 23 and all four crew members returned to the vessel on Monday evening, having first had two 100 lb (45 kg) capacity propane gas cylinders replenished. They had depleted their supply of propane during the trip prior to the last one and, since that time (approximately 6 days before the casualty), had consumed only cold food and mineral water when at sea; there had been no heating in the accommodation.

Weather forecasts for Tuesday, March 24 were adverse and they decided to delay departure until the forecasts had improved; consequently, all four retired to sleep at approximately 2230, two in the sleeping accommodation, one in the wheel-house and one in his vehicle ashore. The full propane cylinders had not been connected at that time.

The vessel's engine and generator had been stopped; therefore, electrical power was supplied from batteries, the batteries being charged by shore power via an electric power cable leading from the vessel to the shore.

Weather forecasts on Tuesday morning indicated that the weather would still be unsuitable for fishing and it was decided by the crew to return to their homes until the forecasts improved. Before leaving the vessel and shortly before 0930, the two full propane cylinders were connected to the system at their position on the port outside wheel-house bulkhead and the two empty cylinders stowed and secured on the foredeck. The water heater in the wheel-house was then turned on and lit and its electrically operated water-circulating pump switched on and observed to be operating. It is not known whether the stove and refrigerator in the accommodation were checked.

When the crew left the vessel at 0930, all lights were switched off, all windows and doors were closed; regarding the two doors to the wheel-house, one was closed and locked, the other was closed but not locked as the lock was faulty. The operating condition of the two full propane cylinders connected to the system was that one was fully open, and the other closed.

The vessel was secured to the outside of a similar vessel which was secured to the wharf.

Weather forecasts improved during Tuesday; therefore, three of the crew members consisting of the skipper, engineer and a deck-hand, accompanied by two of their girlfriends who were to return the vehicle used by the crew members, returned to the vessel at approximately 2230 that evening. It had been decided to depart from Shelburne as quickly as possible and proceed to Halifax, Nova Scotia, in order to resume fishing from that port; the fourth crew member was to re-join the vessel at Halifax.

All five persons boarded the "BENRIC" after their arrival at 2230, each carrying assorted provisions and clothing as they climbed down onto, then across the inboard vessel; all assembled in the wheel-house of the "BENRIC". The engineer then went aft to the engine room and prepared the engine for starting which entailed the opening of various valves and the closing of electrical switches; he returned to the wheel-house and advised the skipper that the engine could be started. The engine was started at approximately 2250.

The engineer then picked up his extra clothing and climbed down the ladder into the accommodation; he switched

on a light and placed his clothing on his bunk, returning to the wheel-house in order to proceed ashore and disconnect the shore electrical power. He had noticed a smell of propane when in the accommodation and remarked on this generally to the four persons still in the wheel-house as he passed through. Having closed the wheel-house door behind him he proceeded ashore, disconnected the powerline and returned to the vessel; he was standing on the afterdeck and was about to stow the line when the explosion occurred, inflicting injuries to his head. The time was now 2310.

Inside the vessel, the skipper was attending to navigational equipment in the wheel-house; his girlfriend was standing near him. The deck-hand had gone below into the accommodation and had called to his girlfriend to pass down one of the spare electric lightbulbs which were kept in the wheel-house; this she had carried out by climbing down the ladder and handing the bulb to him. The explosion occurred immediately afterward and while she was still standing on the ladder. There is no further recollection by the survivors who had been inside the vessel, until they were being administered first-aid some minutes later.

The skipper and his girlfriend suffered multiple fractures to their legs and feet.

The deck-hand died; his girlfriend suffered multiple cuts and abrasions to her face and injuries to her eyes.

The explosion was heard and seen by crew members of the Canadian Coast Guard Ship (CCGS) "ALERT" which was moored some 150 m away at the same wharf; they immediately initiated rescue procedures under the directives of the master, which consisted of:

- telephoned alerts to fire department, ambulance service and Royal Canadian Mounted Police (RCMP),
- rigging of the ship's fire-fighting equipment,
- readying of the ship's first-aid equipment,
- launch of the ship's fast rescue craft.

The "BENRIC" had ignited on exploding but the flames were extinguished by the sea as the vessel sank; it was estimated that she sank within 1.5 minutes from the time of the explosion.

The first persons at the scene arrived within one minute and noticed a strong smell of propane; they observed the

skipper's girlfriend amid the sinking wreckage and the engineer attempting to rescue her. This he accomplished and supported her in the water as he made his way to a ladder on the wharf where one of the crew from the "ALERT" climbed down the ladder and immersed himself in the water in order to give support to both the injured survivors.

The fast rescue craft had been launched by 2315 and arrived at the scene approximately one minute later at which time both of the rescued were lifted on board; the lady was then placed in a basket-stretcher and hoisted to the wharf.

The skipper was found lying on the deck of the inshore vessel to which the "BENRIC" had been moored; the deck-hand's girlfriend was found walking on the jetty. All of the survivors were in shock; all were administered first-aid by the crew of the "ALERT" until the arrival of an ambulance at 2320 when they were transported to the local hospital.

The engineer had advised the rescuers that one person was missing and local divers were called to the scene; they recovered the body of the deck-hand from the submerged wreckage at 0140, March 25.

The stove and refrigerator were later recovered by an RCMP dive team and the remains of the vessel, together with its associated wreckage, were raised on March 31 at which time the water heater was also found.

The three light sockets in the accommodation were recovered and all held the remnants of lightbulbs.

There were two electric switches to the pumps but only one was recovered, in a badly damaged (crushed) condition.

Analysis

1. Propane Gas System

The hot water heater was situated on the port after side of the wheel-house on the deck above the accommodation, heated water being circulated by pump through pipes and radiators in the accommodation.

The galley stove and refrigerator were situated on the after starboard side of the eating area and against the transverse watertight bulkhead which separated the accommodation from the fish hold. The stove was on the deck and the refrigerator, which was incorporated into cupboards, was approximately 0.3 m above and to the left of the stove.

All three appliances received propane gas through standard 9.525 mm (3/8") internal diameter copper tubes. The main line led to the refrigerator with T junctions providing lines to the water heater and stove.

The main line led into the galley through the outer deck from a pressure regulator secured to the port outer side of the wheel-house bulkhead. The regulator was of the type that can be switched to receive gas from either of two cylinders. The two full cylinders were each connected by copper tubing to the regulator; the valve on one was fully open, the other closed. Both cylinders were resting on the deck and were secured to the port outer side of the wheel-house bulkhead.

The water heater was fitted with a pilot light which automatically ignited the burner to produce water heated to settings made on a thermostat.

The refrigerator was operated by a continuous flame of 1,000 BTU per hour and was fitted with a device which automatically closed the gas outlet if the flame became extinguished, as required by regulation. (See Liquefied Petroleum Gas (LPG) Regulations, section 25, contained in the annex to this report). To re-open the gas outlet the closing device had to be re-set.

The stove had four top burners of 5,200 BTU per hour each, which required to be lit by hand, and an oven burner of 7,100 BTU per hour which was automatically ignited from a continuous burning pilot-light when turned on: the pilot light was ignited by hand.

The stove oven pilot-light was fitted with a device which automatically closed the gas outlets to the oven burner and pilot-light if the pilot-light became extinguished, as required by regulation. To re-open the gas outlets the closing device had to be re-set.

The stove burners were not fitted with such devices nor were they required to be by regulation. However, a master valve which shut off gas to all stove burners was incorporated in the oven switch and marked 'pilot-light off'.

The "BENRIC" was not equipped with a gas detecting device in any of her compartments, nor was she required to be by regulation.

2. Operational Condition of the Appliances When Recovered

The appliances were damaged but all the switches to the gas outlets were still in a condition such as to clearly indicate their positions. They were:

Water heater	-	switched on.
Refrigerator	-	switched on.
Stove-top burners	-	of the 4 burners, 3 were switched on in the high position, the other switched off.
Oven burner and pilot-light	-	the oven was switched to pilot-light on.

The switches were all of the type that require to be depressed before they can be switched from the off position; therefore, they are considered to have been at the above positions prior to the explosion. In this case, even if the automatic closing devices on the refrigerator and oven pilot-light had closed, gas would still have been free to flow through the 3 stove-top burners due to the oven switch being in the pilot light on position and the 3 top burners open.

3. Propane Installation and Inspection

The three propane appliances and pipework had been renewed by the owner during January 1986 and since then had been used many times without cause for concern by the users; none of the appliances nor the pipework, connections and pressure regulator had been modified or repaired since that time.

The installation and use of liquefied petroleum gas in ships are governed by the LPG regulations made pursuant to the Canada Shipping Act. These regulations apply to all vessels inspected by the Ship Safety Branch of the Canadian Coast Guard. The "BENRIC", being a fishing vessel of over 15 gross tons, was an inspected vessel and these regulations therefore applied. The regulations state that the submission of plans of propane installations to the Ship Safety Branch of the Canadian Coast Guard for approval is not required for vessels of not more than 24.4 m in length, however, the equipment should be installed in accordance with the LPG Regulations and to the satisfaction of an inspector when

installed on a ship which is required to be inspected. (See sections 3 and 12 of the LPG Regulations.)

The appliances all bore the approval of the Canadian Gas Association and the installation was reportedly made in accordance with LPG Regulations but their installation had not been reported and consequently not inspected by an inspector; the last periodic steamship inspection had taken place on January 28, 1985, some 12 months before the appliances and installation had been renewed. It is the responsibility of the owner/operator to ensure that the Ship Safety Branch of the Canadian Coast Guard, is advised of any alteration or modification to a ship which requires inspection.

It was the accepted practice by the crew to make their own inspection periodically and especially when changing propane cylinders.

Whether or not the stove and refrigerator were checked and turned off prior to the last cylinder change is not known. The responsibilities amongst the three crew members on board that morning were such that, the deceased had been the person designated to attend to that particular task; the others did not inspect or touch the appliances except for starting the water heater in the wheel-house.

Section 37, Subsection (1) of the LPG Regulations requires that:

> Before opening a gas cylinder valve ..... all valves and pilot lights of gas burning appliances shall be shut off before the cylinder valve is opened.

4. Force of Explosion

The explosion occurred in the accommodation below the wheel-house and was sufficient to blow the foredeck and wheel-house completely off the vessel, destroy the bulkhead between accommodation and fish hold and split the stem, blowing out the stem-post. It was described as consisting of a large white flash with an orange centre, accompanied by a loud report.

5. Propane Gas Lines

The condition of the lines and connections prior to the explosion could not be ascertained from the remnants recovered except that those remnants appeared to have

once been in good condition.

6. **Cause of Propane Gas Leak**

The deceased crew member had had the specific task of attending to the stove and refrigerator and to replenishing and changing the gas cylinders. The crew member who was not involved in the explosion but who had slept on board the vessel during the Monday night assisted in connecting the full cylinders during the Tuesday morning but did not know whether the stove and refrigerator had been checked, nor did the other crew members who had gone about their own specific tasks.

The propane gas system had not been in use since exhausting the previous gas supply some 6 days earlier, during which time the vessel had made 1.5 trips. One possibility is that the gas line had fractured at some time after exhausting the previous supply, then gas had leaked into the accommodation and bilge after the replenished cylinders had been connected.

However, the refrigerator, oven pilot-light and the three burners were in the 'on' position when recovered from the wreckage which indicates that the system had been left in the 'on' position since the exhaustion of the previous supply; the automatic closing devices to oven and refrigerator had operated but propane gas had been free to leak into the accommodation via the open top burners once the full cylinders had been connected and one of them opened.

There is no knowledge of any person boarding the vessel during the absence of the crew or of any reason why the burners, oven pilot light and refrigerator flame should have been turned on and not lit.

7. **Leaked Propane**

It is calculated that, if the three top burners of the stove had been in the 'on' position from the time of connecting the full cylinders to the system, then approximately 13 hours, 40 minutes would have elapsed to the time of explosion and approximately 10.37 lb of propane would have leaked into the accommodation and the bilge below the accommodation deck. The air space in the bilge and accommodation is calculated to have been approximately 50 m^3. Liquid propane produces approximately 0.24 m^3 of gas for each pound in weight; therefore, the volume of the gas would have been approximately 2.49 m^3, which represents an approximate 5% gas

to air mixture; the most volatile is considered to be 4.6%.

8. Characteristics of Propane

Propane is originally odourless but is scented by the manufacturers in order to give it a distinctive smell. Its vapours are initially 1.5 times heavier than air; consequently, they will sink to the lowest level of a compartment in which the air is still and not being ventilated.

The heavier concentrations of gas will settle at the lower part of the compartment. The vapours have been known to travel to a source of ignition and flash back.

9. Ventilation

All windows and doors were closed on leaving the vessel at 0930 Tuesday; the only source of ventilation to the accommodation was a plastic pipe of 76 mm diameter which projected above the wheel-house roof; the bottom of the pipe cleared the accommodation deck by about 50 mm. This was a natural ventilator and required the movement of air past the outside open-end to draw air from the accommodation. Tuesday had been fine and calm inside the harbour, therefore, the ventilator would have operated at its least effectiveness.

10. Electric Fresh-Water Pumps

The accommodation deck was raised approximately 1.2 m above the keel and the space under the deck (bilge) contained a metal fresh-water tank and two electrically operated pumps, one for pumping fresh water to a sink, the other for draining the sink overboard.

A hatch in the deck close to the stove gave access to the two electrical pumps in the bilge. This had been left open after repairs had been attempted to the fresh water pump; the pump was inoperative. The bilge was not directly ventilated.

11. Accommodation Lighting

Three overhead electric lightbulbs provided illumination to the galley/eating area; there were no lights in the sleeping area as sufficient light entered through a central doorway in the partition bulkhead when the galley/eating area lights were switched on.

The three lightbulbs were operated by switches contained in their receptacles and were each switched on and off by pulling a small chain; there was nothing to indicate whether they were switched on or off except for the light from a bulb. Electric power to the receptacles was provided through a circuit breaker in the wheelhouse which was kept in the 'on' position.

Three light sockets were fitted in the general area, but only two had operating bulbs prior to the explosion; the other had been removed for use elsewhere and at that time there were no spares.

12. Other Explosive Material On Board

The only other explosive material on board, apart from the diesel oil for the engine and which did not ignite, was a partly filled plastic gasoline container which had been stowed on deck and was later found intact and securely closed.

13. Cause of Explosion

When the engineer, who was the first to enter the accommodation, had descended the ladder, his first act was to walk into the galley area and reach up and pull a chain switching on a light, thus giving sufficient illumination to obtain an anti sea-sickness device from a cupboard; it was during this process that he noticed the smell of propane. He did not look at the stove nor hear the sound of escaping gas, however, propane emission from unlit burners is practically inaudible.

The deceased was the next person to enter the accommodation and it is believed that he did so in order to investigate the cause of the gas leak; he required extra light and placed a bulb in the empty socket.

The only other electric connections in the accommodation were switches for the two pumps and it is doubtful if they had been closed as one pump was known to be inoperative and the other, which drained the sink, was not needed. A part of only one of the two switches was found but it was too badly damaged to indicate whether it was closed or not.

Consideration has been given to the cause being the opening of the burners by the deceased on entering the accommodation and then attempting to light them, the gas having leaked from another source such as broken gas lines; however, it is doubtful if this occurred as he

was believed to be investigating the leak and was specifically in charge of propane.

Consideration has been given to the cause being the lit hot water heater, however, this was situated in the aft part of the wheel-house on the deck above the accommodation. It was working correctly and the smell of propane was not noticed in the wheel-house.

Consideration has also been given to the cause being gas drawn through the bilge to the engine-room when the engine was started and then ignited by electric sparks such as from the generator, however, both watertight bulkheads appeared to have been sound. The engine-room was well ventilated and was separated from the accommodation by the two watertight bulkheads. The engine had been running for approximately 20 minutes and there was no indication of fire or explosive damage in the engine-room.

The remnant of the bulb in the receptacle that had been empty was found to be not fully seated and required a further turn of approximately 3 mm. The other two bulb remnants were fully seated.

It is most probable that the explosion was caused by gas vapours which had settled in the lower part of the accommodation being disturbed by the passage of persons in the accommodation which, on reaching the empty light socket, were ignited by an electric arc to the base of the bulb as it was being fitted, or from the arc to the switch points as the light was switched on, the resulting flash igniting gas accumulated in the bilge and lower part of the accommodation.

14. Reconstruction of Events Following the Explosion

When he had sufficiently recovered from his head injuries, the engineer, who had been standing on the afterdeck, ran to the inboard vessel where he found the skipper and lifted wreckage off him. The skipper had been blown from the wheel-house onto the deck of the inboard vessel.

The engineer then jumped into the wreckage of the sinking "BENRIC" in order to rescue the skipper's girlfriend who had fallen back into the wreckage after being blown from the wheel-house.

The deceased's girlfriend was found walking about on the wharf. She had been standing on the ladder in the

accommodation below the wheel-house and it is presumed that the explosion propelled her from the accommodation onto the inboard vessel from where she climbed onto the wharf.

The deceased was later found in the submerged wreckage of the accommodation.

15. **Crew Qualifications and Experience**

The skipper had been in command of the "BENRIC" for approximately one year and had been fishing for 3½ years, all on "BENRIC". He held no formal marine qualifications nor was he required to by regulation.

The engineer had been engineer on the "BENRIC" for 9 months since completing a course on marine diesel engines at a vocational school. He held no formal marine qualifications nor was he required to by regulation.

The deceased deck-hand had served on the "BENRIC" for 17 months. He held no formal marine qualifications nor was he required to by regulation.

The other deck-hand, who was not involved in the explosion, had been fishing for 3½ years, the last 2½ years on "BENRIC". He also held no formal marine qualifications nor was he required to by regulation.

Findings

The Canadian inshore fishing vessel "BENRIC" exploded and sank at her berth in Shelburne Harbour, Nova Scotia, with the resultant death of one crew member and injuries to four other persons.

The explosion occurred due to the ignition of a quantity of propane gas which had leaked into the forward accommodation section of the vessel. The precise causes of the leakage and ignition could not be positively determined, however, it would appear that:

- a gas cylinder valve was opened and the appliance valves were not closed in contravention of Section 37, Subsection (1) of the Liquefied Petroleum Gas Regulations;

- gas leaked from three of four burners at the top of the galley stove during a period of some 13 hours, 40 minutes and accumulated in the bilge and lower

part of the accommodation, and

- the gas was ignited by an electric arc to the base of a bulb as the bulb was being fitted to a receptacle.

Other Findings

Some, if not all, of the crew members and guests should have immediately withdrawn from the vessel when the smell of propane was detected, until the precise situation had been assessed.

The renewed propane gas system had not been reported to the Canadian Coast Guard and was not therefore inspected by the Ship Safety Branch; however, this is not considered to be a contributing factor to the casualty.

The casualty emphasizes the care which must accompany the safe use and maintenance of liquefied petroleum gas appliances.

Gas detectors are commercially available, though not required by regulation, and are in use on many similar type vessels which carry LPG appliances.

The ventilation of gas from the accommodation and bilge, had it been attempted, would have been difficult to accomplish with the existing ventilation system and without the use of a gas detector.

The fast, positive reaction to the casualty by the crew of the CCGS "ALERT" led to the rapid rescue of the survivors, possibly preventing other fatalities.

The action by the engineer on the "BENRIC" of rescuing one of the more seriously injured persons, although he himself was injured, is commendable.

OTTAWA, ONTARIO
JUNE 1987.

CHAPTER 1437

CANADA SHIPPING ACT

Liquefied Petroleum Gas Regulations

REGULATIONS RESPECTING LIQUEFIED PETROLEUM GAS SYSTEMS IN SHIPS

Short Title

1. These Regulations may be cited as the *Liquefied Petroleum Gas Regulations*.

Interpretation

2. In these Regulations,

"Act" means the *Canada Shipping Act*; (*Loi*)

"Board" means the Board of Steamship Inspection; (*Bureau*)

"Chairman" means the Chairman of the Board; (*président*)

"Divisional Supervisor" means the officer of the Department of Transport in charge of a Steamship Inspection Division and includes the Regional Superintendent of a Steamship Inspection Division; (*surveillant divisionnaire*)

"inspector" means a steamship inspector appointed under the Act; (*inspecteur*)

"length" means

(*a*) in the case of a vessel that is registered under the Act or required by the Act to be registered

(i) the distance from the forepart of the uppermost end of the stem to the aft side of the head of the stern-post except that if a stern-post is not fitted to the vessel, the measurement shall be taken to the foreside of the head of the rudder stock,

(ii) if the vessel has no rudder stock or has a rudder stock situated outside of the hull at the stern, the distance from the foreside of the foremost permanent structure to the aft side of the aftermost permanent structure of the vessel, not including guards or rubbing strakes, or

(iii) if the vessel is double-ended, the distance from the aft side of the forward rudder stock to the foreside of the after rudder stock, and

(*b*) in the case of a vessel other than a vessel described in paragraph (*a*), the horizontal distance measured between perpendiculars erected at the extreme ends of the outside of the hull; (*longueur*)

"liquefied petroleum gas" means any liquefied inflammable gas that is composed predominantly of hydrocarbons or mixtures of hydrocarbons such as propane, propylene, butane, butylene or butadene, and that has a Reid vapour pressure exceeding 276 kPa absolute at 38°C. (*gaz de pétrole liquéfié*)

CHAPITRE 1437

LOI SUR LA MARINE MARCHANDE DU CANADA

Règlement sur le gaz de pétrole liquéfié

RÈGLEMENT CONCERNANT LES SYSTÈMES À GAZ DE PÉTROLE LIQUÉFIÉ À BORD DES NAVIRES

Titre abrégé

1. Le présent règlement peut être cité sous le titre: *Règlement sur le gaz de pétrole liquéfié*.

Interprétation

2. Dans le présent règlement,

«Bureau» désigne le Bureau d'inspection des navires à vapeur; (*Board*)

«gaz de pétrole liquéfié» désigne tout gaz inflammable liquéfié qui est composé principalement d'hydrocarbures ou de mélanges d'hydrocarbures, comme le propane, le propylène, le butane, le butylène ou le butadène, et qui possède une tension de vapeur absolue (Reid) de plus de 276 kPa à 38°C; (*liquefied petroleum gas*)

«inspecteur» désigne un inspecteur de navires à vapeur, nommé en vertu de la Loi; (*inspector*)

«Loi» désigne la *Loi sur la marine marchande du Canada*; (*Act*)

«longueur» désigne

a) dans le cas d'un navire immatriculé en vertu de la Loi ou tenu d'être immatriculé en vertu de la Loi,

(i) la distance à partir de la partie avant de l'extrémité supérieure de l'étrave jusqu'à la face arrière de la tête de l'étambot; toutefois, si le navire n'a pas d'étambot, la distance sera mesurée jusqu'à l'avant de la tête de la mèche inférieure,

(ii) si le navire n'a pas de mèche inférieure ou a une mèche inférieure à l'extérieur de la coque à l'arrière, la distance à partir de la face avant de la construction permanente la plus à l'avant jusqu'à la face arrière de la construction permanente la plus à l'arrière du navire, à l'exclusion des défenses ou des ceintures, ou

(iii) si les extrémités du navire sont identiques, la distance à partir de la face arrière de la mèche inférieure avant jusqu'à la face avant de la mèche inférieure arrière, et

b) dans le cas d'un navire autre qu'un navire décrit à l'alinéa *a*), la distance horizontale mesurée entre des perpendiculaires, tirées aux points extrêmes de la coque, à l'extérieur; (*length*)

«président» désigne le président du Bureau d'inspection des navires à vapeur; (*Chairman*)

«surveillant divisionnaire» désigne le fonctionnaire du ministère des Transports qui est responsable d'une division d'inspec-

Application

3. (1) These Regulations apply to all ships that are required by the Act to be inspected.

(2) Notwithstanding subsection (1), the Board may, if satisfied that it is safe to do so, exempt any ship from compliance with any or all of these Regulations.

Use of Liquefied Petroleum Gas

4. (1) No liquefied petroleum gas system of a type other than the vapour withdrawal type shall be installed or used in a ship.

(2) No cylinder that permits gas in liquid form to enter any other part of the gas system of a ship shall be used.

5. (1) Subject to subsection (2), no liquefied petroleum gas system shall be installed or used in a passenger ship.

(2) Subsection (1) does not apply to liquefied petroleum gas systems installed in passenger ships prior to January 1, 1955, if such installations otherwise comply with these Regulations.

6. Liquefied petroleum gas when used on ships shall be effectively odorized by an agent of such character as will indicate by a distinctive odour the presence of gas down to a concentration in air of not over one-fifth the lower limit of combustibility.

7. All component parts of gas-burning appliances on a ship, except the cylinders, shall be tested and approved for liquefied petroleum gas service and shall bear the approved label, seal or mark of the Underwriters' Laboratories of Canada, the Underwriters' Laboratories Incorporated, the American Gas Association Testing Laboratories or any other testing laboratory recognized by the Board.

8. All component parts of the gas system of a ship, except cylinders, appliances and low pressure piping, shall be designed to withstand a pressure of 3.45 MPa without rupturing.

9. (1) Cylinders in which liquefied petroleum gas is stored and handled on a ship shall be constructed, tested, marked, maintained and retested in accordance with the requirements of the Canadian Transport Commission or of the Interstate Commerce Commission of the United States.

(2) All liquefied petroleum gas cylinders in service on a ship shall be marked with a test date indicating that they have been retested in accordance with the requirements of the regulatory bodies referred to in subsection (1) and cylinders not so marked shall not be used.

(3) A liquefied petroleum gas cylinder shall be rejected for further service regardless of the date of its previous test if

tion des navires à vapeur et comprend le surintendant régional d'une division d'inspection des navires à vapeur. (*Divisional Supervisor*)

Application

3. (1) Le présent règlement s'applique à tous les navires à vapeur dont l'inspection est exigée par la Loi.

(2) Par dérogation aux dispositions du paragraphe (1), le Bureau pourra, s'il estime que la sécurité le permet, dispenser un navire de l'obligation de se conformer en totalité ou en partie aux prescriptions du présent règlement.

Emploi du gaz de pétrole liquéfié

4. (1) Aucun système à gaz de pétrole liquéfié qui n'est pas du type dit à évacuation de vapeur ne sera installé ni utilisé à bord d'un navire.

(2) Aucun cylindre qui permet au gaz liquéfié de pénétrer à l'état liquide dans une autre partie du système à gaz d'un navire ne sera utilisé.

5. (1) Sous réserve du paragraphe (2), aucun système à gaz de pétrole liquéfié ne sera installé ni utilisé à bord d'un navire à passagers.

(2) Le paragraphe (1) ne s'applique pas aux systèmes à gaz de pétrole liquéfié installés sur les navires à passagers avant le 1er janvier 1955, si ces installations répondent, sous les autres rapports, aux prescriptions du présent règlement.

6. Au gaz de pétrole liquéfié, utilisé sur les navires, sera adjoint un agent odorifique de nature à lui donner une odeur caractéristique permettant de déceler la présence de gaz dès que la concentration dans l'air atteindra un cinquième de la limite inférieure de combustibilité.

7. Toutes les pièces constituantes des appareils à gaz à bord d'un navire, à l'exception des cylindres, seront éprouvées et approuvées pour le service de gaz de pétrole liquéfié et porteront l'étiquette, le sceau ou la marque approuvés des Underwriters' Laboratories of Canada, des Underwriters' Laboratories Incorporated, des American Gas Association Testing Laboratories ou de tout autre laboratoire d'essai reconnu par le Bureau.

8. Toutes les pièces constituantes du système à gaz d'un navire, à l'exception des cylindres, des appareils et du tuyautage à basse pression, seront conçues de façon à pouvoir résister, sans se rompre, à une pression de 3,45 MPa.

9. (1) Les cylindres servant à l'emmagasinage et à la manutention du gaz de pétrole liquéfié sur un navire seront construits, éprouvés, marqués, entretenus et éprouvés de nouveau en conformité des exigences de la Commission canadienne des transports ou de l'Interstate Commerce Commission des États-Unis.

(2) Tous les cylindres à gaz de pétrole liquéfié en service sur un navire porteront une date d'épreuve indiquant qu'ils ont été éprouvés de nouveau suivant les exigences des organismes de réglementation mentionnés au paragraphe (1), et les cylindres ne portant pas une telle indication ne seront pas utilisés.

(3) Quelle que soit la date de l'épreuve antérieure, un cylindre à gaz de pétrole liquéfié sera rejeté

(*a*) it leaks;

(*b*) it is weakened appreciably by corrosion, denting or bulging or shows other evidence of rough usage;

(*c*) it has lost five per cent of its tare weight; or

(*d*) it has been involved in a fire.

10. Relief valves, shut-off valves, excess flow valves and pressure regulators in the gas system of a ship shall be tested and approved by and bear the label, seal or mark of the Underwriters' Laboratories of Canada, the Underwriters' Laboratories Incorporated, the American Gas Association Testing Laboratories or any other testing laboratory recognized by the Board.

11. The location and installation in a ship of gas-burning appliances, gas cylinders and regulating equipment, together with all piping, shall be in accordance with these Regulations and to the satisfaction of the inspector and where any doubt exists as to the safety of any part of an installation, the matter shall be referred by the inspector to the Chairman.

Submission of Plans

12. (1) Plans in triplicate, showing the location and installation of all piping, gas-burning appliances, gas cylinders, cylinder enclosures and other component parts of the gas system to be installed in ships more than 24.4 m in length shall be submitted to the Divisional Supervisor for approval on behalf of the Board, and no gas system shall be installed except in accordance with approved plans.

(2) In the case of ships not more than 24.4 m in length, the submission of plans is not required but all equipment referred to in subsection (1) shall be installed in accordance with these Regulations and to the satisfaction of the inspector.

Piping

13. All piping in the gas system of a ship shall be so installed as to provide minimum interior runs with adequate flexibility.

14. Piping between the gas cylinders and gas-burning appliances of a ship shall be seamless annealed copper tubing or such other tubing as may be approved by the Chairman.

15. In the gas system of a ship the high pressure piping between the gas cylinders and the regulators shall have a minimum wall thickness of 1.24 mm and the low pressure piping between the regulators and the gas-burning appliances shall have a minimum thickness of 0.81 mm.

16. Pipe connections in the gas system of a ship shall be of the flared type or shall be brazed with material having a melting point in excess of 538°C and the number of connections shall be kept to a minimum.

a) s'il a une fuite;

b) s'il est sensiblement affaibli par suite de corrosion, de renfoncement ou de bombement ou s'il présente d'autres indices d'usage brutal;

c) s'il a perdu cinq pour cent de son poids à vide; ou

d) s'il a été impliqué dans un incendie.

10. Les soupapes de sûreté, les soupapes d'arrêt, les soupapes d'excès de débit et les mano-détendeurs du système à gaz d'un navire seront éprouvés et approuvés par les Underwriters' Laboratories of Canada, les Underwriters' Laboratories Incorporated, les American Gas Association Testing Laboratories ou tout autre laboratoire d'essai reconnu par le Bureau et porteront l'étiquette, le sceau ou la marque de ces laboratoires.

11. L'emplacement et l'installation sur un navire, des appareils à gaz, des cylindres à gaz et des accessoires de détente, ainsi que toute la tuyauterie, répondront aux prescriptions du présent règlement et seront réalisés à la satisfaction de l'inspecteur, et en cas de doute sur la sûreté d'une partie quelconque d'une installation, l'inspecteur devra en référer au président.

Présentation des plans

12. (1) Des plans en triple exemplaire, indiquant l'emplacement et l'installation du tuyautage, des appareils à gaz, des cylindres à gaz, des enceintes de cylindre et des autres pièces constituantes du système à gaz à installer sur les navires de plus de 24,4 m de longueur seront présentés au surveillant divisionnaire pour approbation pour le compte du Bureau, et aucun système à gaz ne pourra être installé si ce n'est conformément aux plans ainsi approuvés.

(2) Dans le cas des navires d'au plus 24,4 m de longueur, la présentation de plans n'est pas exigée mais l'installation de tout le matériel mentionné au paragraphe (1) devra répondre aux prescriptions du présent règlement et être réalisée à la satisfaction de l'inspecteur.

Tuyautage

13. Tout le tuyautage du système à gaz d'un navire sera installé de façon à réduire au minimum le parcours des conduites à l'intérieur des espaces fermés et à offrir une souplesse suffisante.

14. Le tuyautage compris entre les cylindres à gaz et les appareils à gaz sur un navire sera formé de tubes de cuivre recuit sans couture ou de tous autres tubes approuvés par le président.

15. Dans un système à gaz d'un navire, les tuyaux à haute pression compris entre les cylindres à gaz et les mano-détendeurs auront une paroi d'épaisseur minimum de 1,24 mm, alors que les tuyaux à basse pression compris entre les mano-détendeurs et les appareils à gaz auront une épaisseur minimum de 0,81 mm.

16. Les raccords de tuyaux dans un système à gaz d'un navire seront du type évasé ou seront brasés avec une matière ayant un point de fusion supérieur à 538°C et leur nombre sera tenu au minimum.

17. (1) Distribution piping in the gas system of a ship shall, on completion of its installation, be tested prior to its connection to the regulator and gas-burning appliance by an air pressure of not less than 34.5 kPa.

(2) After satisfactory completion of the test prescribed in subsection (1), the distribution piping shall be connected to the regulator and gas-burning appliance and the entire gas system of the ship shall be subjected to the leakage tests prescribed in section 41.

(3) The leakage tests prescribed by section 41 shall be made in the distribution piping at each periodic inspection of the ship.

18. All pipe lines in the gas system of a ship shall

(*a*) be exposed to sight and protected from physical damage as far as is practicable;

(*b*) be securely supported against vibration by soft nonferrous clips; and

(*c*) where passing through steel decks or bulkheads, be protected by ferrules of non-abrasive material.

Valves and Regulators

19. All valves and regulators embodied in the gas system of a ship for the purpose of pressure relief, regulation or control of gas pressure and flow rates shall be securely mounted in a position readily accessible for inspection, maintenance and testing, and shall be adequately protected.

20. (1) Each cylinder in the gas system of a ship shall have a manually operated screw-down, shut-off valve, fitted with a handwheel and mounted directly on the cylinder outlet and shall be fitted with a safety relief device that is

(*a*) approved as to type, size, pressure setting and location, in accordance with the requirements of the Canadian Transport Commission or the Interstate Commerce Commission of the United States;

(*b*) integral with the shut-off valve referred to in this subsection; and

(*c*) a spring-loaded relief valve with a supplementary fusible plug that is designed to yield when the cylinder has been emptied of liquid gas by the relief valve under conditions of exposure to excessive heat.

(2) The spring-loaded relief valve, the fusible plug and the shut-off valve referred to in subsection (1) shall each have direct communication with the vapor space of a gas cylinder.

(3) A multiple cylinder gas system shall be provided with a manually operated two-way positive shut-off manifold valve so arranged that the replacement of empty cylinders may be made without shutting down the flow of gas in the gas system of a ship.

21. A master packless shut-off valve controlling all burners simultaneously shall be installed at the manifold of each gas-burning appliance on a ship.

17. (1) L'installation terminée, le tuyautage de distribution dans un système à gaz d'un navire devra, avant d'être raccordé au mano-détendeur et à l'appareil à gaz, être éprouvé sous une pression d'air d'au moins 34,5 kPa.

(2) Après exécution satisfaisante de l'épreuve prescrite au paragraphe (1), le tuyautage de distribution sera raccordé au mano-détendeur et à l'appareil à gaz, et le système à gaz tout entier d'un navire sera soumis à l'épreuve de fuite prescrite à l'article 41.

(3) Les épreuves de fuite prescrites à l'article 41 seront applicables au tuyautage de distribution lors de chaque inspection périodique du navire.

18. Toutes les conduites d'un système à gaz d'un navire devront

a) être, autant que possible, exposées à la vue et protégées contre les dommages matériels;

b) être solidement soutenues par des colliers souples non ferreux afin d'atténuer les vibrations; et

c) être protégées, où elles traversent des ponts ou cloisons en acier, par des viroles en matière non abrasive.

Soupapes et mano-détendeurs

19. Les soupapes et les mano-détendeurs du système à gaz d'un navire qui servent à réduire la pression et à régulariser ou régler la pression et le débit du gaz seront tous solidement montés en des endroits d'accès facile à l'inspection, à l'entretien et à l'épreuve, et seront convenablement protégés.

20. (1) Chaque cylindre du système à gaz d'un navire aura une soupape d'arrêt à tige filetée et à commande manuelle munie d'un volant et montée directement sur la sortie du cylindre même et sera muni d'un dispositif de décompression

a) approuvé quant au genre, aux dimensions, au tarage et à l'emplacement, conformément aux prescriptions de la Commission canadienne des transports ou de l'Interstate Commerce Commission des États-Unis;

b) solidaire de la soupape d'arrêt mentionnée au présent paragraphe; et

c) constitué par une soupape de sûreté à ressort avec un bouchon fusible supplémentaire conçu de façon à céder lorsque la soupape de sûreté, sous l'effet de l'exposition à une chaleur excessive, a vidé le cylindre du gaz liquide qu'il contenait.

(2) La soupape de sûreté à ressort, le bouchon fusible et la soupape d'arrêt mentionnés au paragraphe (1) seront chacun en communication directe avec l'espace de vapeur du cylindre à gaz.

(3) Un système à gaz à cylindres multiples aura une soupape de collecteur à deux voies à fermeture manuelle, disposée de façon à permettre de remplacer les cylindres vides sans interrompre le débit du gaz dans le système à gaz d'un navire.

21. Une soupape d'arrêt principale sans garniture sera installée au collecteur de chaque appareil à gaz d'un navire pour en fermer simultanément tous les becs.

22. The gas system of a ship shall be provided with a regulating device so adjusted as to release gas to the consuming appliance at a pressure not in excess of 4.5 kPa.

23. The low pressure side of all regulators in the gas system of a ship shall be protected against excessive pressure by means of a suitable relief valve that shall be integral with the regulator and set to discharge at a pressure of not less than twice and not more than three times the delivery pressure.

24. All reducing regulators in the gas system of a ship shall be fitted with a pressure gauge located on the high pressure side of the regulator.

Burners

25. Continuous burning pilot lights and other continuous flame devices are prohibited for use on gas-burning appliances installed below the weather deck of a ship unless the appliance is fitted with a device that automatically shuts off the gas in the main supply line to the appliance when the pilot light or continuous flame is extinguished.

Installation

26. Sections 27 to 31 apply to ships more than 24.4 m in length.

27. (1) Cylinders and their regulating and relief equipment in the gas system of a ship shall be located

(*a*) in a well ventilated, substantially constructed and firmly secured metal enclosure on or above the weather deck level and outside the superstructure, cabins and the hull of the ship, access to which enclosure is from the weather deck only; and

(*b*) so that any gas escaping therefrom cannot reach the bilges, machinery space, accommodation or other enclosed space.

(2) Cylinders in the gas system of a ship shall be suitably secured in place and mounted in an upright position in a metal enclosure.

28. (1) Spare and empty gas cylinders shall be stored within the metal enclosure referred to in subsection 27(1) or properly chocked and secured on the weather deck of a ship and protected from the sun or heat by a suitable cover and adequately ventilated.

(2) The metal enclosure referred to in subsection 27(1) shall be closed at all times except when access is required to change cylinders in the gas system of the ship or maintain equipment, and nothing shall be stored therein except

(*a*) liquefied petroleum gas cylinders and permanently fastened parts of the system; and

(*b*) any valve protecting caps for cylinders in use that are rigidly fastened to the metal enclosure.

(3) All relief valves on gas cylinders shall discharge into the metal enclosure referred to in subsection 27(1) and shall be vented away from the cylinders and, so far as may be practicable, upward into the atmosphere, but in all cases so as to prevent impingement of the escaping gas onto the cylinders.

22. Le système à gaz d'un navire sera muni d'un dispositif de détente réglé de façon à laisser passer du gaz vers les appareils sous une pression ne dépassant pas 4,5 kPa.

23. Le côté basse pression de tous les mano-détendeurs dans le système à gaz d'un navire sera protégé contre toute pression excessive au moyen d'une soupape de sûreté appropriée solidaire du mano-détendeur et réglée de façon à laisser le gaz s'échapper à une pression non inférieure au double ni supérieure au triple de la pression de débit.

24. Tous les mano-détendeurs dans le système à gaz d'un navire seront munis d'un manomètre placé sur leur côté haute pression.

Becs

25. L'emploi de veilleuses et autres dispositifs à flamme continue est interdit sur les appareils à gaz installés au-dessous du pont découvert d'un navire, sauf si ces appareils sont munis d'un dispositif qui coupe automatiquement l'arrivée du gaz de la canalisation principale en cas d'extinction de la veilleuse ou autre dispositif à flamme continue.

Installations

26. Les articles 27 à 31 s'appliquent aux navires de plus de 24,4 m de longueur.

27. (1) Les cylindres du système à gaz d'un navire, ainsi que leurs accessoires de détente et de sûreté, seront logés

a) dans une enceinte métallique bien ventilée, solidement construite et fermement assujettie, soit au niveau du pont découvert, soit au-dessus, à l'extérieur de la superstructure, des cabines et de la coque du navire, et n'offrant accès que du pont découvert; et

b) de façon que tout gaz venant à s'échapper ne puisse pas atteindre les fonds de cale, ni la tranche des machines, ni les locaux d'habitation, ni les autres espaces fermés.

(2) Les cylindres du système à gaz d'un navire seront bien immobilisés et seront montés debout dans une enceinte métallique.

28. (1) Les cylindres à gaz vides ou de rechange seront soit placés dans l'enceinte métallique mentionnée au paragraphe 27(1), seront bien calés et immobilisés sur le pont découvert d'un navire et seront protégés contre le soleil ou la chaleur par un abri convenable et bien ventilé.

(2) L'enceinte métallique mentionnée au paragraphe 27(1) sera tenue fermée en tout temps, sauf lorsque l'accès y est nécessaire pour le remplacement des cylindres dans le système à gaz d'un navire ou l'entretien du matériel, et rien n'y sera emmagasiné à l'exception

a) des cylindres de gaz de pétrole liquéfié et des pièces du système fixées à demeure; et

b) des chapeaux de soupapes des cylindres en usage qui sont rigidement fixés à l'enceinte métallique.

(3) Toutes les soupapes de sûreté des cydindres à gaz devront débiter dans l'enceinte métallique mentionnée au paragraphe 27(1) et diriger les gaz loin des cylindres et, autant que possible, vers le haut dans l'atmosphère, mais dans tous les cas

29. (1) Compartments of a ship containing gas-burning appliances that are located above the weather deck shall be ventilated by

(*a*) at least two natural air ventilator ducts each at least 75 mm in diameter and led from the atmosphere, of which one duct shall extend to the floor level of the compartment and the other duct shall extend to the overhead of the compartment; or

(*b*) mechanical ventilation if the motor is outside the compartment and the exhaust ventilating duct.

(2) Compartments of a ship containing gas-burning appliances that are located entirely below the weather deck shall be ventilated by mechanical or power ventilation of the positive extraction type having sufficient capacity to effect a change of air at least once every 6 minutes through ventilators led from the atmosphere, one ventilator of which shall extend to the floor level and another to the overhead of the compartment.

30. The electrical fittings and equipment installed in compartments, galleys or other places on a ship that contain gas-burning appliances shall be installed in accordance with the electrical rules of Lloyd's Register of Shipping, the recommended practice of the American Institute of Electrical Engineers or the *Steamship Machinery Construction Regulations*.

31. No electrical connections shall be made within the metal enclosure on a ship that houses gas cylinders.

Location and Protection of Gas Cylinders

32. Sections 33 to 36 apply to ships not more than 24.4 m in length.

33. (1) Gas cylinders and their regulating and relief equipment on a ship shall be

(*a*) suitably protected from damage and from the sun or heat; and

(*b*) properly secured on or above the weather deck level, outside the superstructure and not within the hull.

(2) Gas cylinders and the regulating and safety equipment on a ship shall be so located that gas escaping from any cause cannot reach the bilges, machinery space, accommodation or other enclosed space.

(3) The discharge from relief valves of gas cylinders shall be directed

(*a*) in such a manner as to prevent the force of escaping gas from direct contact with the cylinders; and

(*b*) where possible, upwards into the atmosphere.

34. Spare and empty gas cylinders shall be properly chocked and secured on the weather deck of a ship and protected from the sun or heat in a manner satisfactory to the inspector.

de façon à empêcher les gaz qui s'échappent de venir en contact avec les cylindres.

29. (1) Les compartiments qui renferment des appareils à gaz et qui sont situés au-dessus du pont découvert seront ventilés

a) soit par au moins deux conduites d'aérage naturel ayant au moins 75 mm de diamètre et étant en communication avec l'atmosphère, dont l'une ira jusqu'au niveau du plancher et l'autre jusqu'au plafond du compartiment; ou

b) soit par des moyens mécaniques si le moteur se trouve à l'extérieur du compartiment et de la conduite de sortie pour la ventilation.

(2) Les compartiments d'un navire qui renferment des appareils à gaz et qui sont situés entièrement en dessous du pont découvert seront ventilés par un ventilateur mécanique du type aspirant suffisamment puissant pour renouveler l'air au moins toutes les 6 minutes par des conduites d'aérage en communication avec l'atmosphère, dont l'une ira jusqu'au niveau du plancher et l'autre jusqu'au plafond du compartiment.

30. Les accessoires et le matériel électriques des compartiments, des cuisines ou d'autres lieux sur un navire qui renferment des appareils à gaz seront installés suivant les règles sur l'électricité du Lloyd's Register of Shipping, les pratiques recommandées de l'American Institute of Electrical Engineers ou le *Règlement sur la construction des machines des navires à vapeur*.

31. Aucune connexion électrique ne sera effectuée dans l'enceinte métallique d'un navire où sont logés les cylindres de gaz.

Situation et protection des cylindres à gaz

32. Les articles 33 à 36 s'appliquent aux navires d'au plus 24,4 m de longueur.

33. (1) Les cylindres à gaz, ainsi que leurs accessoires de détente et de sûreté, seront

a) bien protégés contre les dommages et contre le soleil ou la chaleur; et

b) convenablement assujettis au niveau du pont découvert, ou au-dessus, à l'extérieur de la superstructure et non dans la coque.

(2) Les cylindres à gaz, ainsi que leurs accessoires de détente et de sûreté sur un navire, seront situés de façon que le gaz venant à s'échapper ne puisse pas atteindre les fonds de cale, ni la tranche des machines, ni les locaux d'habitation, ni les autres espaces fermés.

(3) L'évacuation par les soupapes de sûreté des cylindres à gaz sera dirigé de manière

a) à empêcher le jet de gaz qui s'échappe de venir en contact direct avec les cylindres; et

b) à monter dans l'atmosphère, si possible.

34. Les cylindres à gaz vides et de rechange seront convenablement calés et immobilisés sur le pont découvert du navire et protégés contre le soleil ou la chaleur à la satisfaction de l'inspecteur.

35. Compartments on a ship containing gas-burning appliances shall be efficiently ventilated to the satisfaction of the inspector.

36. The electrical fittings in compartments, galleys and other places on a ship that contain gas-burning appliances shall be installed and maintained to the satisfaction of the inspector.

Operation of Gas-burning Appliances

37. (1) Before opening a gas cylinder valve, the cylinder shall be securely fastened and the outlet of the cylinder shall be connected tightly to the gas system of a ship, and where a single cylinder only is used, all valves and pilot lights of gas-burning appliances shall be shut off before the cylinder valve is opened.

(2) When a gas cylinder is not in use or is exhausted, its outlet valve shall be kept closed.

(3) Valve protecting caps, if provided, shall be firmly in place on all cylinders not attached to the gas system of a ship.

38. The master packless shut-off valve controlling the gas supply to a gas-burning appliance on a ship shall be shut when the appliance is not in use.

39. Smoking on a ship is prohibited in the vicinity of gas cylinder storage.

40. The presence of any gas odour on a ship shall be reported immediately to the master of the ship.

41. (1) The gas system of a ship shall be tested for leakage by

(*a*) noting the pressure on the gauge when the appliance burner valves are shut and the packless shut-off valve and one cylinder valve are open, and

(*b*) noting if the pressure on the gauge remains constant for at least 10 minutes when the cylinder valve referred to in paragraph (*a*) is closed.

(2) If the pressure on the gauge drops before the expiration of the 10 minutes referred to in paragraph (1)(*b*), the leakage shall be located by the application of liquid detergent or soap water solution at all connections of the gas system.

(3) The tests referred to in subsection (1) shall be repeated for each cylinder in a multi-cylinder gas system.

(4) Flame shall never be used to test for leaks in a gas system.

42. The operating instructions contained in sections 37 to 41 shall be framed under glass and posted in a conspicuous place in the vicinity of the gas cylinders and also near the most frequently used gas-burning appliance where they may be easily read.

43. (1) Subject to subsection (2), the outside of the metal enclosure housing liquefied petroleum gas cylinders, valves and regulators shall be marked as follows:

35. Les compartiments sur un navire qui renferment des appareils à gaz seront efficacement ventilés à la satisfaction de l'inspecteur.

36. Les accessoires électriques des compartiments, des cuisines et d'autres lieux sur un navire qui renferment des appareils à gaz seront installés et entretenus à la satisfaction de l'inspecteur.

Utilisation des appareils à gaz

37. (1) Avant que la soupape d'un cylindre ne soit ouverte, le cylindre sera bien assujetti et la sortie du cylindre sera raccordée hermétiquement au système à gaz d'un navire, et lorsqu'un seul cylindre est utilisé, toutes les soupapes et veilleuses des appareils à gaz seront fermées avant que la soupape du cylindre ne soit ouverte.

(2) Lorsqu'un cylindre à gaz ne sert pas ou est vide, sa soupape de sortie devra demeurer fermée.

(3) Les chapeaux de soupapes, s'il y en a, devront être fermement en place sur tous les cylindres qui ne sont pas raccordés au système à gaz d'un navire.

38. La soupape d'arrêt principale sans garniture qui commande l'alimentation en gaz d'un appareil sera fermée lorsque l'appareil à gaz ne sert pas.

39. Il est interdit de fumer à proximité de l'entrepôt des cylindres à gaz.

40. La présence de toute odeur de gaz sur un navire sera signalée d'urgence au capitaine du navire.

41. (1) Le système à gaz d'un navire doit être soumis à l'épreuve de fuite en notant

a) la pression indiquée par le manomètre lorsque, les soupapes des becs des appareils étant fermées, la soupape d'arrêt sans garniture et une soupape de cylindre sont ouvertes; et

b) si la pression indiquée par le manomètre reste constante pendant au moins 10 minutes, lorsqu'on ferme la soupape de cylindre mentionnée à l'alinéa *a*).

(2) Si la pression manométrique tombe avant l'expiration des 10 minutes mentionnées à l'alinéa (1)*b*), la fuite doit être repérée en appliquant sur tous les raccords du système à gaz un détergent liquide ou une solution d'eau savonneuse.

(3) Répéter pour chaque cylindre les épreuves mentionnées au paragraphe (1), dans le cas d'un système à cylindres multiples.

(4) Ne jamais utiliser de flamme pour rechercher une fuite.

42. Les consignes d'utilisation contenues aux articles 37 à 41 seront encadrées sous verre et affichées en un endroit bien en vue au voisinage des cylindres de gaz et près de l'appareil à gaz le plus souvent utilisé, de façon que la lecture en soit facile.

43. (1) Sous réserve du paragraphe (2), l'enceinte métallique abritant des cylindres de gaz de pétrole liquéfié, les soupapes et les mano-détendeurs, portera l'inscription suivante à l'extérieur:

"LIQUEFIED PETROLEUM GAS
KEEP OPEN FIRES AWAY
NO SMOKING
OPERATING INSTRUCTIONS LOCATED ....."

(2) In the case of a ship not requiring a metal enclosure for housing gas cylinders, the markings shall be placed immediately above the gas cylinders.

44. Printed instructions for the proper installation, operation and maintenance of each gas-burning appliance shall be furnished by the manufacturer and posted in the ship.

«GAZ DE PÉTROLE LIQUÉFIÉ
TENIR LES FLAMMES NUES À DISTANCE
DÉFENSE DE FUMER
LES CONSIGNES D'UTILISATION SE TROUVENT.....»

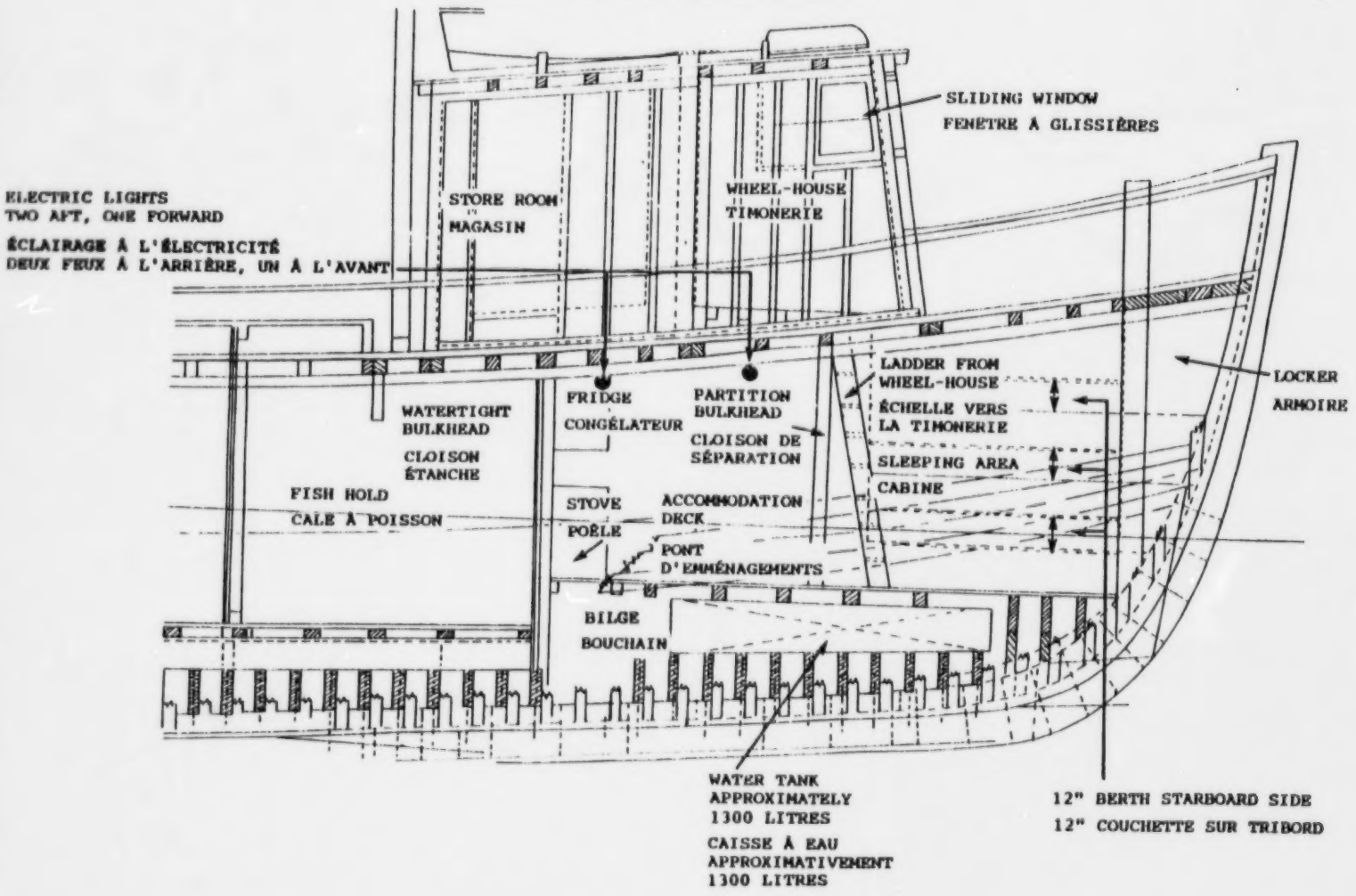
(2) Dans le cas d'un navire pour lequel il n'est pas exigé d'enceinte métallique pour abriter les cylindres de gaz, l'inscription sera placée juste au-dessus des cylindres de gaz.

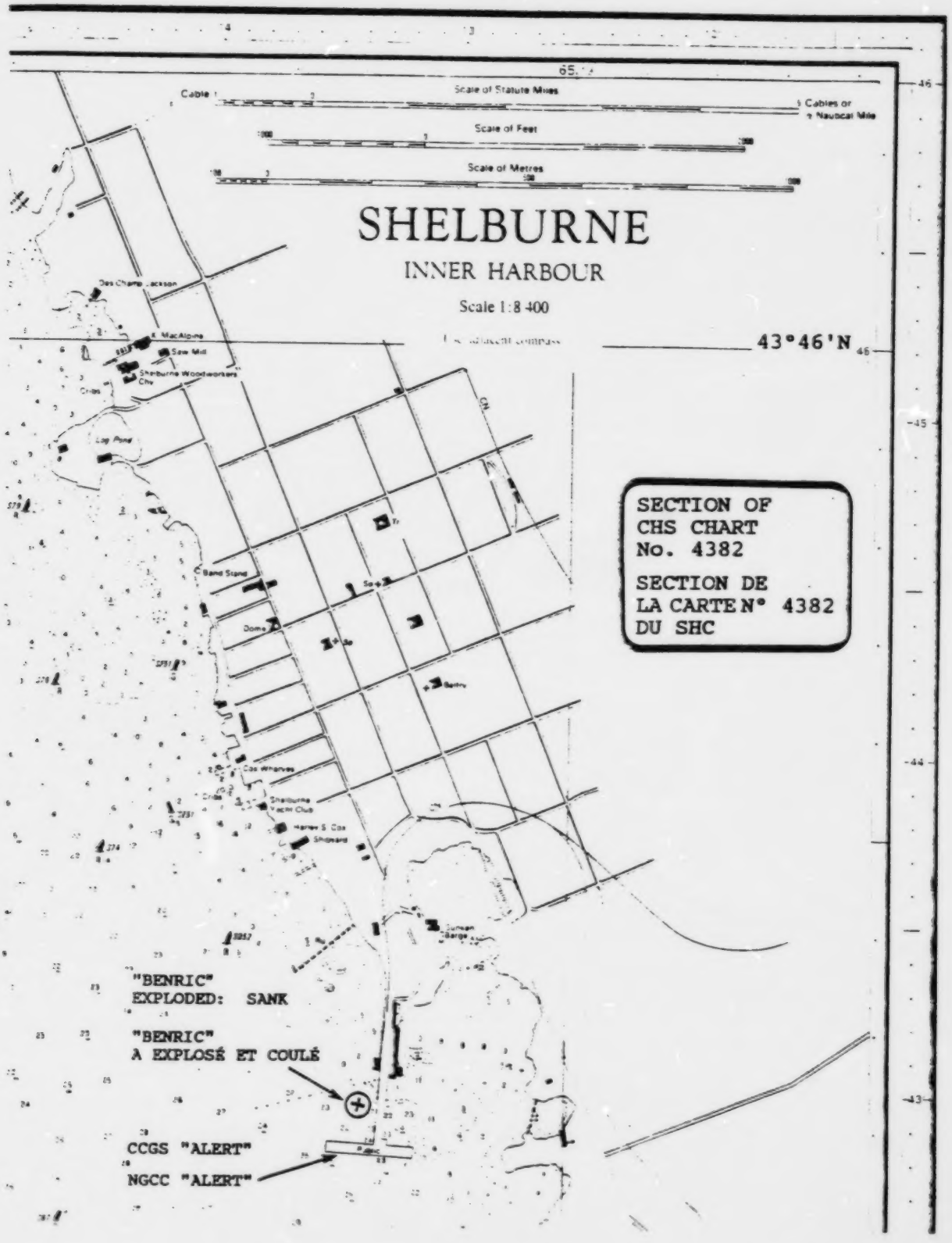
44. Une notice concernant l'installation, la manœuvre et l'entretien convenables de chaque appareil à gaz sera fournie par le fabricant et affichée à bord du navire.

QUEEN'S PRINTER FOR CANADA © IMPRIMEUR DE LA REINE POUR LE CANADA
OTTAWA, 1978

COPY OF BLUEPRINT PLAN OF
FORWARD SECTION "BENRIC"

COPIE DU TIRAGE BLEU DE
LA SECTION AVANT DU "BENRIC"




SHELBURNE
INNER HARBOUR
Scale 1:8 400
Scale of Statute Miles
Scale of Feet
Scale of Metres
43°46'N
SECTION OF CHS CHART No. 4382
SECTION DE LA CARTE N° 4382 DU SHC
"BENRIC" EXPLODED: SANK
"BENRIC" A EXPLOSÉ ET COULÉ
CCGS "ALERT"
NGCC "ALERT"

"BENRIC"

"BENRIC" shortly after building, 1968. Some modifications had been made since that time but hull and wheel-house were the same.

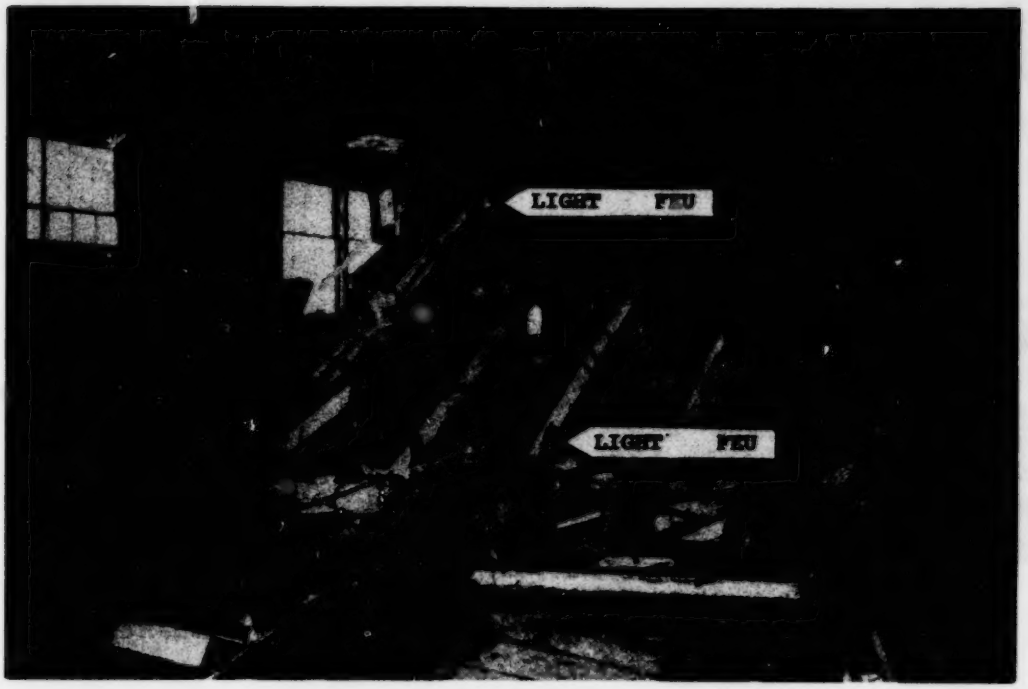
"BENRIC" peu de temps après sa construction en 1968. Quelques modifications ont été apportées depuis mais la coque et la timonerie sont inchangées.

"BENRIC"

Wreckage of "BENRIC" being raised at Shelburne March 3, 1987. Note: transverse uprights are the remains of the water-tight bulkhead between accommodation and fish-hold.

L'épave du "BENRIC" renfloué à Shelburne le 3 mars 1987. A remarquer: les montants transversals sont les restes de la cloison étanche entre les emménagements et la cale à poisson.

"BENRIC"



Wreckage of wheel-house, deck, etc.. Two of three light fixtures indicated attached to transverse deck beams.

Débris du pont de la timonerie, etc.. Deux des trois ampoules de fixture indiqués sont assujettis aux barreaux transversaux.

"BENRIC"

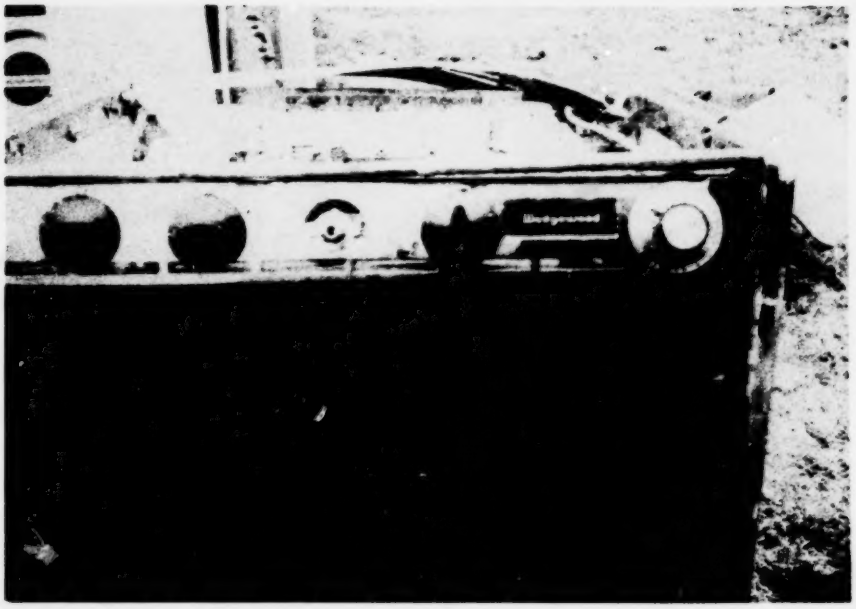
Light fixture into which bulb was being fitted immediately prior to explosion with bulb remnants removed.

Socle auquel l'ampoule était vissé immédiatement avant l'explosion incluant le reste de l'ampoule.

Surface wreckage March 25, 1987.

Débris à la surface d'un naufrage le 25 mars 1987.

"BENRIC"



STOVE. NOTE: Extreme right knob controls the oven in the 'pilot on' position. Other knobs: one missing, three in high position, one off.

POÊLE. NOTA: Le bouton extrême droit règle le four quand le pilote est en marche. Autres boutons: un manquant, 3 à la position maximum, un fermé.